



NON - BEAM

HAZARDS

[PREVIOUS](#)

[NEXT](#)



The laser radiation is not the only hazard during laser operation !

Every laser application is a source of hazards.
Exposure to laser radiation is the main hazard. In addition there are hazards associated with the laser application.
These non-beam hazards include

- fire hazards
- chemical hazards
- electrical hazards
- laser generated air contaminants

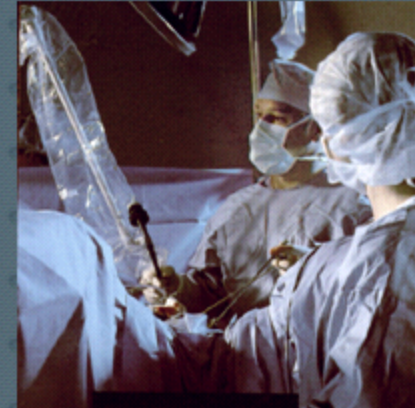
PREVIOUS

NEXT

Flammable material must not be exposed to laser radiation.

When powerful lasers are used, flammable material is a source for fire hazards. Hazards are caused by material in the [beam delivery system] at the [target site] [around] the target site

Direct and specularly reflected laser beams cause the biggest fire hazards.



PREVIOUS

NEXT

Flammable material must not be exposed to laser radiation.

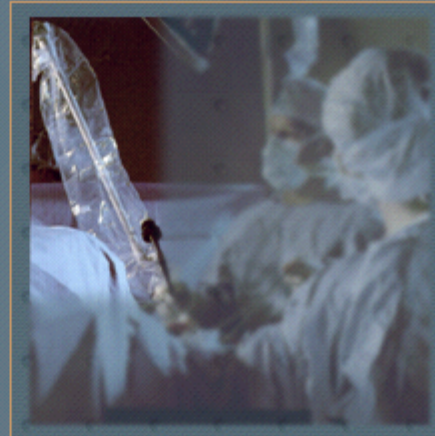
When powerful lasers are used, flammable material is a source for fire hazards. Hazards are caused by material

Broken – and even damaged – fibers may allow escaping laser radiation and put persons within the laser controlled area at risk.

As a consequence of broken fibers, plastic coatings may be ignited.

When using an endoscope, the fiber has to be inserted completely until the fiber tip is [visible].

If the endoscope has a plastic coating this must not be exposed to laser radiation !



PREVIOUS

NEXT

Flammable material must not be exposed to laser radiation.

A serious problem is the use of [endotracheal tubes].
If such a tube consists of flammable material a patient's life may be in danger!
To minimize that hazard, tubes should not be made of flammable material.
Additionally, the oxygen concentration should be kept as low as possible.
Nitrous oxide supports combustion and should not be used.

Laser induced fires may occur in polyvinyl chloride (PVC) if a hole is melted through by a laser allowing oxygen to escape and support combustion.
Wrapping the endotracheal tube with aluminum tape does not adequately protect the patient.

Do not use combustible anesthetic agents (such as cyclopropane) in surgery.

Irrigation of the bowel might be necessary to prevent combustion of bowel gases such as methane.



PREVIOUS

NEXT

Flammable material must not be exposed to laser radiation.

A serious problem is the use of [endotracheal tubes].
If such a tube consists of flammable material, it is a hazard.
To minimize that hazard, tubes should be made of non-flammable material.
Additionally, the oxygen concentration should be kept low.
Nitrous oxide supports combustion.



danger!
l.

Laser induced fires may occur in polyvinyl chloride (PVC) if a hole is melted through by a laser allowing oxygen to escape and support combustion. Wrapping the endotracheal tube with aluminum tape does not adequately protect the patient.

Do not use combustible anesthetic agents (such as cyclopropane) in surgery.

Irrigation of the bowel might be necessary to prevent combustion of bowel gases such as methane.



PREVIOUS

NEXT

Flammable material must not be exposed to laser radiation.

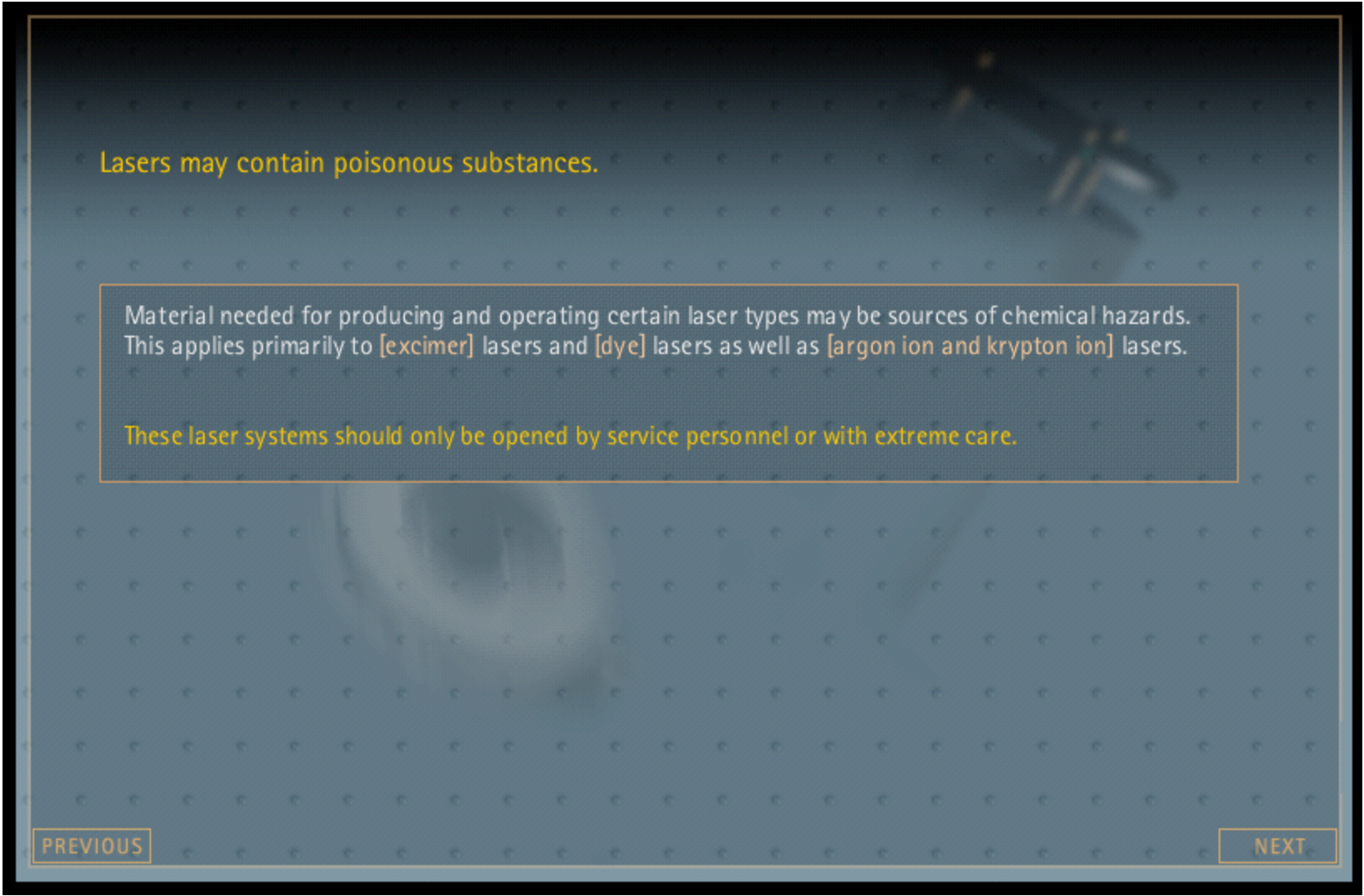
When powerful lasers are used, flammable material is a source for fire hazards. Hazards are caused by material in the [beam delivery system] at the [target site]

In order to protect tissue adjacent to the target site, cloth and drapes are used within the operative field. These items should be fire retardant or moistened with sterile water or isotonic lotion. A filled syringe should also be at hand. Personal clothing is also flammable.



PREVIOUS

NEXT



Lasers may contain poisonous substances.

Material needed for producing and operating certain laser types may be sources of chemical hazards. This applies primarily to [excimer] lasers and [dye] lasers as well as [argon ion and krypton ion] lasers.

These laser systems should only be opened by service personnel or with extreme care.

PREVIOUS

NEXT

Lasers may contain poisonous substances.

Material needed for producing and operating certain laser types may be sources of chemical hazards.

Excimer laser that are operated with ArF, KrF, XeF and XeCl contain either fluorine or chlorine gases.

Chlorine is poisonous, fluorine is even more poisonous !

as well as [argon ion and krypton ion] lasers.

personnel or with extreme care.

The escape of these gases has to be prevented. The gas containers have to be stored very carefully and should only be of the pre-mix type. However, modern excimer lasers usually prevent escape of gases by the design of the enclosure.

PREVIOUS

NEXT

Lasers may contain poisonous substances.

Material needed for producing and operating certain laser types may be sources of chemical hazards.

Most of the organic dyes used in dye laser systems are highly poisonous. Replacing the dye containers may therefore be a hazardous activity. Service should be carried out by service personnel only.

If dye containers must be replaced, extreme care has to be taken !

[argon ion and krypton ion] lasers.

extreme care.

When replacing dye containers, instructions by the manufacturer are to be strictly observed. Skin contact and inhaling vapors must be avoided. Wastes have to be disposed of in an approved manner.

PREVIOUS

NEXT

Lasers may contain poisonous substances.

Material needed for producing and operating certain laser types may be sources of chemical hazards. This applies primarily to [excimer] lasers and [dye] lasers.

These laser systems should only be opened by service personnel.

The laser tubes of argon ion and krypton ion lasers contain beryllium oxide. Beryllium is a highly poisonous substance which may escape in case of a damaged laser tube. Those tubes must be handled with extreme care !

PREVIOUS

NEXT

Service or repairs of the power supply unit must be carried out only by trained personnel.

Due to the very low [efficiency] of some types of lasers, many need a very powerful electrical supply. Such power supplies are hazardous when the housing of the laser product is open and if the interior parts are manipulated.

[!]

All laser products shall be installed and operated in conformity with the National Electric Code (NFPA 70).

The [UL logo] on a laser product indicates the electrical safety of a product with respect to its dedicated use. As long as you do not open the power supply and touch the interior parts, you are not at risk.



PREVIOUS

NEXT

Service or repairs of the power supply unit must be carried out only by trained personnel.

The efficiency of a laser system describes the conversion of electrical energy into optical radiation. If a laser output power of 1 Watt is required, the laser system needs [considerably] more electrical power. Laser diodes have the highest efficiency of all laser types at up to 40 %, a CO₂ laser can reach 15 %, a Nd:YAG laser a maximum of 10 %. Other lasers transform less than 1 % of electrical power into light.

[!]

All laser products shall be installed and operated in conformity with the National Electric Code (NFPA 70).

The [UL logo] on a laser product indicates the electrical safety of a product with respect to its dedicated use. As long as you do not open the power supply and touch the interior parts, you are not at risk.



PREVIOUS

NEXT

Service or repairs of the power supply unit must be carried out only by trained personnel.

The efficiency of a laser system describes the conversion of electrical energy into optical radiation. If a laser output power of 1 Watt is

required, the laser system needs
Laser diodes have the highest efficiency
a CO₂ laser can reach 15 %, a Nd:YAG laser
lasers transform less than 1 % of electrical power into light.

As an example: an argon ion laser which emits 5 Watts of optical power requires an electrical input of 20 000 Watts !

[!]

All laser products shall be installed and operated in conformity with the National Electric Code (NFPA 70).

The [UL logo] on a laser product indicates the electrical safety of a product with respect to its dedicated use. As long as you do not open the power supply and touch the interior parts, you are not at risk.



PREVIOUS

NEXT

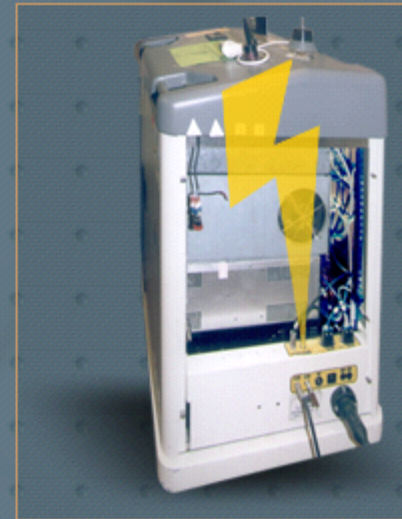
Service or repairs of the power supply unit must be carried out only by trained personnel.

Due to the very low [efficiency] of some types of lasers, many need a very powerful electrical supply.
Such power supplies are hazardous when the housing of the laser product is open and if the interior parts are manipulated.

Cords and cables should be checked regularly !
Electrical conductors must not get into contact with cooling water.

the National Electric Code (NFPA 70).

The [UL logo] on a laser product indicates the electrical safety of a product with respect to its dedicated use. As long as you do not open the power supply and touch the interior parts, you are not at risk.



PREVIOUS

NEXT

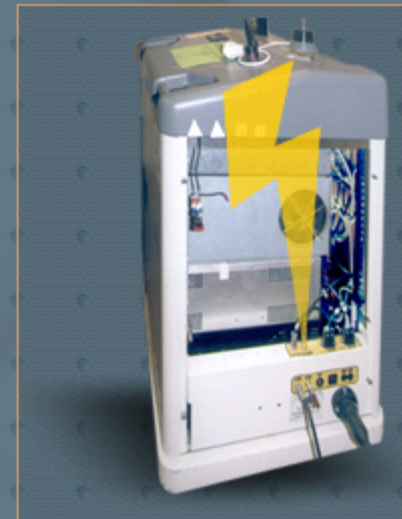
Service or repairs of the power supply unit must be carried out only by trained personnel.

Due to the very low [efficiency] of some types of lasers, many need a very powerful electrical supply. Such power supplies are hazardous when the housing of the laser product is open and if the interior parts are manipulated.

[!]

All laser products shall be installed and operated in conformity with the National Electric Code (NFPA 70).

manufacturer's certification label indicates the electrical safety of a product. As long as you do not open the power supply and touch the interior parts, you are not at risk.



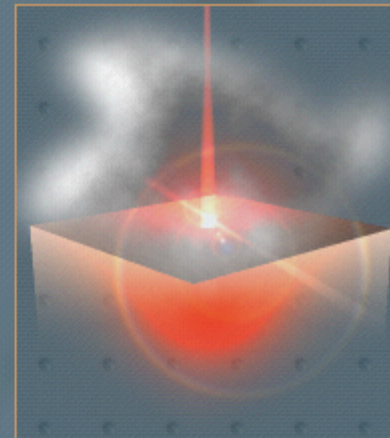
PREVIOUS

NEXT

Airborne contaminants have to be extracted.

The laser operation is a source of hazardous airborne contaminants. Lasers capable of vaporization can result in a plume ejected from the impact site. These [LGACs] may contain biological particles as well as gases and non-viable particulates. These laser generated [aerosols] spoil the visibility and they may cause sickness when inhaled.

The contaminants must be [evacuated] directly from the site where they are generated !



PREVIOUS

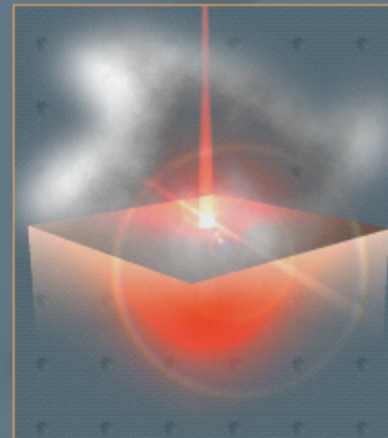
NEXT

Airborne contaminants have to be extracted.

The laser operation is a source of hazardous airborne contaminants. Lasers capable of generating a plume ejected from the implosion point. These laser generated [aerosols] spoil the visibility and they may cause sickness when inhaled.

Laser-Generated Airborne Contaminants

The contaminants must be [evacuated] directly from the site where they are generated !



PREVIOUS

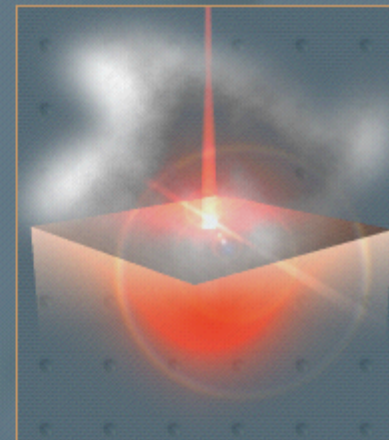
NEXT

Airborne contaminants have to be extracted.

The laser operation is a source of hazardous airborne contaminants. Lasers capable of vaporization can result in a plume ejected from the impact site. These [LGACs] may contain biological particles as well as gases and non-viable particulates. These laser generated cause sickness when in

The contaminants must be extracted where they are generated.

Dust and fog particles with diameters from 0.01 up to 50 μm are called aerosols. Particles of that size can enter the trachea and lung and cause adverse health effects.



PREVIOUS

NEXT

Airborne contaminants have to be extracted.

The laser operation is a source of hazardous airborne contaminants. Lasers capable of vaporization can result in a plume ejected from the impact site. These [LGACs] may contain biological particles as well as gases and non-viable particulates. These laser generated [aerosols] spoil the visibility and they may cause sickness when inhaled.

Evacuation should be done with special laser plume extractors placed as close to the target site as possible. Filters have to be changed periodically to remain effective.

y from the site



PREVIOUS

NEXT